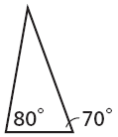
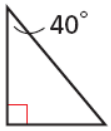
<u>Attendance Problems</u>. Classify each triangle by its angle measures.

1.



2.



3. Simplify: $\left(2\sqrt{3}\right)^2$

4. If $a = 6$, $b = 7$, and $c = 12$, find $a^2 + b^2$ and find c^2. Which value is greater?

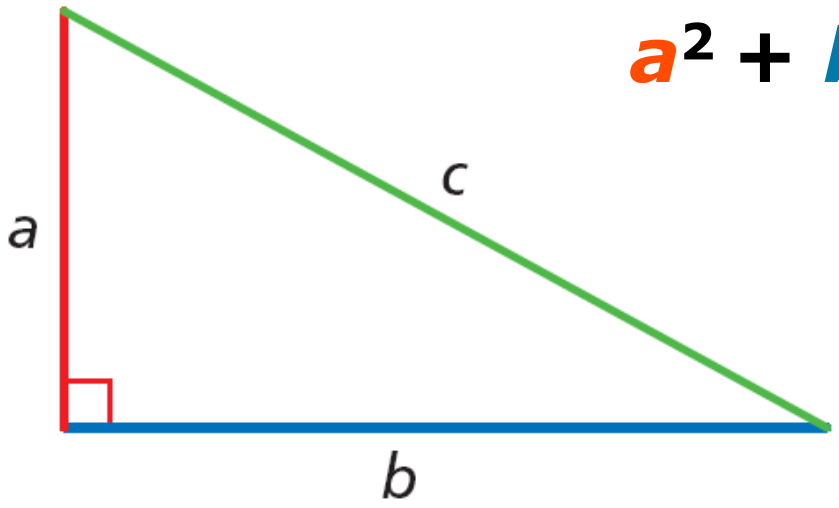
- I can use the Pythagorean Theorem and its converse to solve problems.
- I can use Pythagorean inequalities to classify triangles.

Vocabulary: Pythagorean triple

<u>Common Core</u>

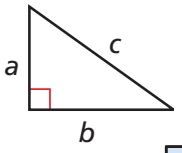
CC.9-12.G.SRT.8 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

CC.9-12.G.SRT.4 Prove theorems about triangles.



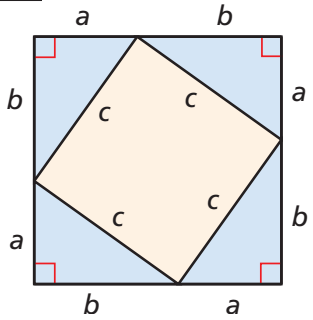
$$a^2 + b^2 = c^2$$

Pythagorean Theorem



Given: A right triangle with leg lengths a and b and hypotenuse of length c

Prove: $a^2 + b^2 = c^2$



Proof: Arrange four copies of the triangle as shown. The sides of the triangles form two squares.

The area of the outer square is $(a + b)^2$. The area of the inner square is c^2. The area of each blue triangle is $\frac{1}{2}ab$.

area of outer square = area of 4 blue triangles + area of inner square

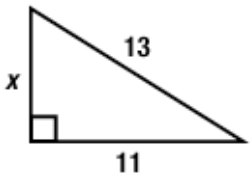
$$(a + b)^2 = 4\left(\frac{1}{2}ab\right) + c^2 \qquad \textit{Substitute the areas.}$$

$$a^2 + 2ab + b^2 = 2ab + c^2 \qquad \textit{Simplify.}$$

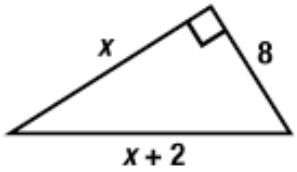
$$a^2 + b^2 = c^2 \qquad \textit{Subtract 2ab from both sides.}$$

Refer to video example 1. Find the value of x. **Write your answer in simplest radical form.**

A.



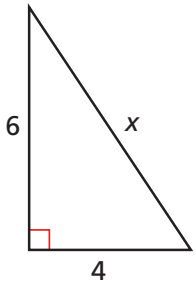
B.



1 Using the Pythagorean Theorem

Find the value of *x*. Give your answer in simplest radical form.

A



$a^2 + b^2 = c^2$ *Pythagorean Theorem*

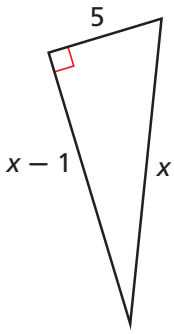
$6^2 + 4^2 = x^2$ *Substitute 6 for a, 4 for b, and x for c.*

$52 = x^2$ *Simplify.*

$\sqrt{52} = x$ *Find the positive square root.*

$x = \sqrt{(4)(13)} = 2\sqrt{13}$ *Simplify the radical.*

B



$a^2 + b^2 = c^2$ *Pythagorean Theorem*

$5^2 + (x - 1)^2 = x^2$ *Substitute 5 for a, x − 1 for b, and x for c.*

$25 + x^2 - 2x + 1 = x^2$ *Multiply.*

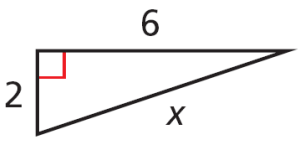
$-2x + 26 = 0$ *Combine like terms.*

$26 = 2x$ *Add 2x to both sides.*

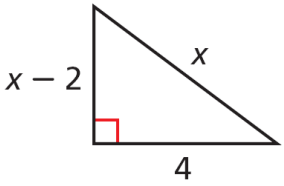
$x = 13$ *Divide both sides by 2.*

Example 1. Find the value of x. **Write your answer in simplest radical form.**

A.

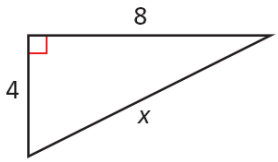


B.

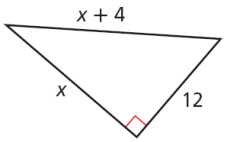


Guided Practice. Write your answer in simplest radical form.

5.

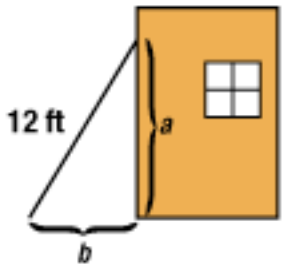


6.



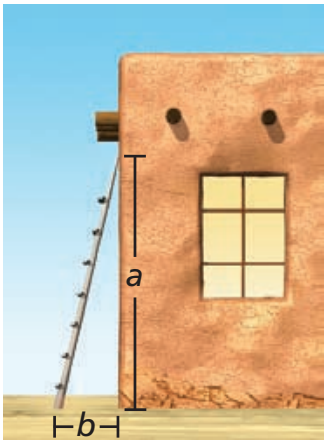
Refer to video example 2.

To prevent a ladder from shifting, safety experts recommend that the ratio of *a*:*b* be 4:1. How far from the base of the wall should you place the foot of a 12-foot ladder. Round to the nearest inch.



2 Safety Application

To prevent a ladder from shifting, safety experts recommend that the ratio of *a*:*b* be 4:1. How far from the base of the wall should you place the foot of a 10-foot ladder? Round to the nearest inch.



Let x be the distance in feet from the foot of the ladder to the base of the wall. Then $4x$ is the distance in feet from the top of the ladder to the base of the wall.

$a^2 + b^2 = c^2$ *Pythagorean Theorem*

$(4x)^2 + x^2 = 10^2$ *Substitute.*

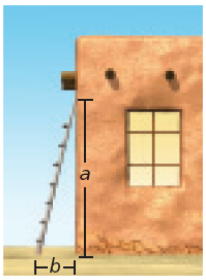
$17x^2 = 100$ *Multiply and combine like terms.*

$x^2 = \frac{100}{17}$ *Divide both sides by 17.*

$x = \sqrt{\frac{100}{17}} \approx 2$ ft 5 in. *Find the positive square root and round it.*

Example 2: Randy is building a rectangular picture frame. He wants the ratio of the length to the width to be 3:1 and the diagonal to be 12 centimeters. How wide should the frame be? Round to the nearest tenth of a centimeter.

7. Guided Practice. According to the recommended safety ratio of 4:1, how high will a 30-foot ladder reach when placed against a wall? Round to the nearest inch.

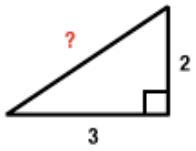


A set of three nonzero whole numbers a, b, and c such that $a^2 + b^2 = c^2$ is called a **Pythagorean triple**.

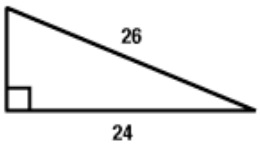
Common Pythagorean Triples			
3, 4, 5	5, 12, 13,	8, 15, 17	7, 24, 25

<u>Refer to video example 3</u>. Find the missing side length. Tell if the side lengths form a Pythagorean triple. Explain.

A.



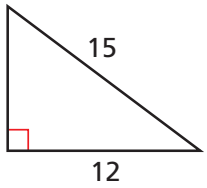
B.



3 Identifying Pythagorean Triples

Find the missing side length. Tell if the side lengths form a Pythagorean triple. Explain.

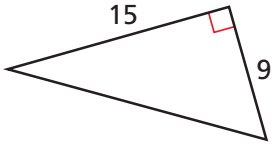
A



$a^2 + b^2 = c^2$	*Pythagorean Theorem*
$12^2 + b^2 = 15^2$	*Substitute 12 for a and 15 for c.*
$b^2 = 81$	*Multiply and subtract 144 from both sides.*
$b = 9$	*Find the positive square root.*

The side lengths are nonzero whole numbers that satisfy the equation $a^2 + b^2 = c^2$, so they form a Pythagorean triple.

B

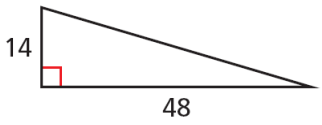


$a^2 + b^2 = c^2$	*Pythagorean Theorem*
$9^2 + 15^2 = c^2$	*Substitute 9 for a and 15 for b.*
$306 = c^2$	*Multiply and add.*
$c = \sqrt{306} = 3\sqrt{34}$	*Find the positive square root and simplify.*

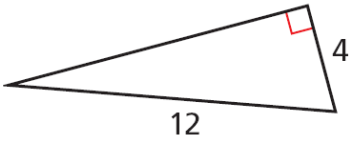
The side lengths do not form a Pythagorean triple because $3\sqrt{34}$ is not a whole number.

<u>Example 3</u>. Find the missing side length. Tell if the side lengths form a Pythagorean triple. Explain.

A.

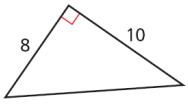


B.

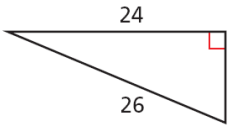


<u>Guided Practice</u>. Find the missing side length. Tell if the side lengths form a Pythagorean triple. Explain.

8.

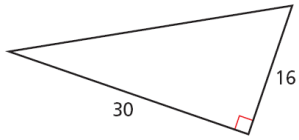


9.



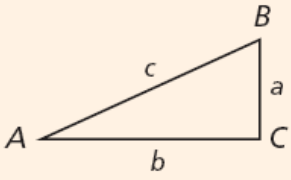
10.

11.



Sketchpad: Converse of the Pythagorean Theorem.

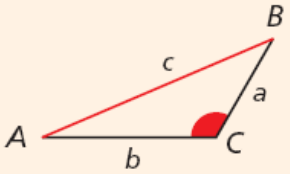
Theorems 5-7-1 **Converse of the Pythagorean Theorem**

THEOREM	HYPOTHESIS	CONCLUSION
If the sum of the squares of the lengths of two sides of a triangle is equal to the square of the length of the third side, then the triangle is a right triangle.	 $a^2 + b^2 = c^2$	$\triangle ABC$ is a right triangle.

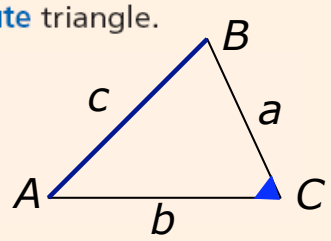
Theorems 5-7-2 **Pythagorean Inequalities Theorem**

In $\triangle ABC$, c is the length of the longest side.

If $c^2 > a^2 + b^2$, then $\triangle ABC$ is an obtuse triangle.



If $c^2 < a^2 + b^2$, then $\triangle ABC$ is an acute triangle.



Remember!

By the Triangle Inequality Theorem, the sum of any two side lengths of a triangle is greater than the third side length.

Refer to video example 4. Tell if the measures can be the side lengths of a triangle. If so, classify the triangle as acute, obtuse, or right.

A. 5, 8, & 10 **B.** 2.3, 7.2, & 9.6

4 Classifying Triangles

Tell if the measures can be the side lengths of a triangle. If so, classify the triangle as acute, obtuse, or right.

A **8, 11, 13**

Step 1 Determine if the measures form a triangle.

By the Triangle Inequality Theorem, 8, 11, and 13 can be the side lengths of a triangle.

Step 2 Classify the triangle.

$c^2 \stackrel{?}{=} a^2 + b^2$ *Compare c^2 to $a^2 + b^2$.*

$13^2 \stackrel{?}{=} 8^2 + 11^2$ *Substitute the longest side length for c.*

$169 \stackrel{?}{=} 64 + 121$ *Multiply.*

$169 < 185$ *Add and compare.*

Since $c^2 < a^2 + b^2$, the triangle is **acute.**

B **5.8, 9.3, 15.6**

Step 1 Determine if the measures form a triangle.

Since $5.8 + 9.3 = 15.1$ and $15.1 \not> 15.6$, these cannot be the side lengths of a triangle.

Example 4. Tell if the measures can be the side lengths of a triangle. If so, classify the triangle as acute, obtuse, or right.

A. 5, 7, & 10 **B.** 5, 8, & 17.

Guided Practice.

12. 7, 12, & 16 **13.** 11, 18, & 34 **14.** 3.8, 4.1 & 5.2

5-7 The Pythagorean Theorem *(p 365)* 15, 17, 18, 19, 21, 23, 25, 26, 27, 30, 36.